

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum) 1.158.PCT

Box No. I TITLE OF INVENTION
Structure of Optically Effective Diffraction Security Elements and Apparatus for Examining such Elements

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

WHD elektronische Prueftechnik GmbH.
Industriestrasse 19
D-01129 Dresden
Germany

☐ This person is also inventor.

Telephone No.
0351 8491556

Facsimile No.
0351 8491596

Teleprinter No.

State (that is, country) of nationality:
Germany

State (that is, country) of residence:
Germany

This person is applicant for the purposes of: ☐ all designated States ☒ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

Puttkammer, Frank
Kastanienstrasse 19
D-01640 Coswig
Germany

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:
Germany

State (that is, country) of residence:
Germany

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☒ the United States of America only ☐ the States indicated in the Supplemental Box

☒ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent ☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

Heitsch, Wolfgang
European Patent Attorney
Goehlsdorfer Strasse 25g
D-14778 Jeserig
Germany

Telephone No.
033207 51138

Facsimile No.
033207 32898

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

Continuation of Box No. III FURTHER APPLICANTS AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet is not to be included in the request.

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

Wolf, Torsten
Radebeuler Strasse 6b
D-01640 Coswig
Germany

This person is:

- ☐ applicant only
☒ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:
Germany

State (that is, country) of residence:
Germany

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of: ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☒ **AP ARIPO Patent:** GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SL Sierra Leone, SZ Swaziland, TZ United Republic of Tanzania, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA Eurasian Patent:** AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian
- ☒ **EP European Patent:** AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☒ **OA OAPI Patent:** BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, GW Guinea-Bissau, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|--|--|
| <input type="checkbox"/> AE United Arab Emirates | <input checked="" type="checkbox"/> LR Liberia |
| <input checked="" type="checkbox"/> AL Albania | <input checked="" type="checkbox"/> LS Lesotho |
| <input checked="" type="checkbox"/> AM Armenia | <input checked="" type="checkbox"/> LT Lithuania |
| <input checked="" type="checkbox"/> AT Austria | <input checked="" type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AU Australia | <input checked="" type="checkbox"/> LV Latvia |
| <input checked="" type="checkbox"/> AZ Azerbaijan | <input type="checkbox"/> MA Morocco |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina | <input checked="" type="checkbox"/> MD Republic of Moldova |
| <input checked="" type="checkbox"/> BB Barbados | <input checked="" type="checkbox"/> MG Madagascar |
| <input checked="" type="checkbox"/> BG Bulgaria | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BR Brazil | |
| <input checked="" type="checkbox"/> BY Belarus | <input checked="" type="checkbox"/> MN Mongolia |
| <input checked="" type="checkbox"/> CA Canada | <input checked="" type="checkbox"/> MW Malawi |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein | <input checked="" type="checkbox"/> MX Mexico |
| <input type="checkbox"/> CN China | <input checked="" type="checkbox"/> NO Norway |
| <input type="checkbox"/> CR Costa Rica | <input checked="" type="checkbox"/> NZ New Zealand |
| <input checked="" type="checkbox"/> CU Cuba | <input checked="" type="checkbox"/> PL Poland |
| <input checked="" type="checkbox"/> CZ Czech Republic | <input checked="" type="checkbox"/> PT Portugal |
| <input type="checkbox"/> DE Germany | <input checked="" type="checkbox"/> RO Romania |
| <input checked="" type="checkbox"/> DK Denmark | <input checked="" type="checkbox"/> RU Russian Federation |
| <input type="checkbox"/> DM Dominica | <input checked="" type="checkbox"/> SD Sudan |
| <input checked="" type="checkbox"/> EE Estonia | <input checked="" type="checkbox"/> SE Sweden |
| <input checked="" type="checkbox"/> ES Spain | <input checked="" type="checkbox"/> SG Singapore |
| <input checked="" type="checkbox"/> FI Finland | <input checked="" type="checkbox"/> SI Slovenia |
| <input checked="" type="checkbox"/> GB United Kingdom | <input checked="" type="checkbox"/> SK Slovakia |
| <input type="checkbox"/> GD Grenada | <input checked="" type="checkbox"/> SL Sierra Leone |
| <input checked="" type="checkbox"/> GE Georgia | <input checked="" type="checkbox"/> TJ Tajikistan |
| <input checked="" type="checkbox"/> GH Ghana | <input checked="" type="checkbox"/> TM Turkmenistan |
| <input checked="" type="checkbox"/> GM Gambia | <input checked="" type="checkbox"/> TR Turkey |
| <input type="checkbox"/> HR Croatia | <input checked="" type="checkbox"/> TT Trinidad and Tobago |
| <input checked="" type="checkbox"/> HU Hungary | <input type="checkbox"/> TZ United Republic of Tanzania |
| <input checked="" type="checkbox"/> ID Indonesia | <input checked="" type="checkbox"/> UA Ukraine |
| <input checked="" type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> UG Uganda |
| <input type="checkbox"/> IN India | <input checked="" type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> IS Iceland | |
| <input checked="" type="checkbox"/> JP Japan | <input checked="" type="checkbox"/> UZ Uzbekistan |
| <input checked="" type="checkbox"/> KE Kenya | <input checked="" type="checkbox"/> VN Viet Nam |
| <input checked="" type="checkbox"/> KG Kyrgyzstan | <input checked="" type="checkbox"/> YU Yugoslavia |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | <input type="checkbox"/> ZA South Africa |
| | <input checked="" type="checkbox"/> ZW Zimbabwe |
| <input checked="" type="checkbox"/> KR Republic of Korea | Check-boxes reserved for designating States which have become party to the PCT after issuance of this sheet: |
| <input checked="" type="checkbox"/> KZ Kazakhstan | <input checked="" type="checkbox"/> GW Guinea-Bissau |
| <input checked="" type="checkbox"/> LC Saint Lucia | <input type="checkbox"/> |
| <input checked="" type="checkbox"/> LK Sri Lanka | |

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation (including fees) must reach the receiving Office within the 15-month time

For receiving Office use only		2. Drawings:
1. Date of actual receipt of the purported international application:		<input type="checkbox"/> received: <input type="checkbox"/> not received:
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent):	ISA/	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.

For International Bureau use only

Date of receipt of the record copy by the International Bureau:

Wolfgang Heitsch, patent attorney, Göhlisdorfer Straße 25g, 14778 Jeserig (Germany)

CONSTRUCTION OF DIFFRACTION-OPTICALLY EFFECTIVE SAFETY ELEMENTS AND A DEVICE FOR TESTING SUCH ELEMENTS

This invention relates to the construction of diffraction-optically effective safety elements and a device for testing such elements.

To date, documents with diffraction-optically effective safety elements, in particular holograms, have been tested with costly optical testing equipment. In these procedures, the test object has to be positioned very exactly. The entire testing process takes so long that these test procedures cannot be used in high-speed processing machines. Testing of, for example, documents with so-called optical variable devices (OVDs) in a document processing machine is impossible, as it runs at a high speed. A method and device of forge testing holographically protected identity cards is disclosed in DE 27 47 156. The OVD is reproduced and a visual check is carried out. This method is not suited to high-speed, efficient, person-independent testing. A device for generating scanning patterns which are tested by means of laser, mirror and lens system as well as a photodetector is described in EP 0 042 946. The economic expenditure is also in this case very high. It would increase further if the test objects are to be tested without prior sorting. To avoid presorting, the forge test system would have to be arranged several times. In addition, demetallizations in diffraction-optically effective safety elements are known which have been tested only by means of optical methods so far.

It is the object of the invention to eliminate the disadvantages of the prior art and to propose a construction of diffraction-optically effective safety elements, in particular OVDs, holograms or kinegrams, which can be tested rapidly, person-independently and

inexpensively. It is another object of the invention to propose a device for the testing of documents containing such safety elements. The device is intended for use in document processing machines as well as manual test units for testing documents with diffraction-optically effective safety elements.

This problem is solved by the following description of the invention.

Holograms and other diffraction-optically effective safety elements for the protection of certificates and other securities as well as banknotes against forging are now used more and more widely. Such documents are, for example, the DEM banknotes issued in 1997 which have a diffraction-optically effective safety element in the form of a kinegram in addition to the electrically conductive safety strip. Rapid testability is another safety stage in the valuation of diffraction-optically effective safety elements as a feature of authenticity. Diffraction-optically effective safety elements are composed of a metallized layer, among other things. This metallization layer is electrically conductive. The electrical conductivity changes with the thickness of the layer. In accordance with the invention, the diffraction-optically effective safety element has a discontinuous metallization layer and/or partially metallic layers and/or zones of metallic layers in different planes which represent an aimed electrical coding of information. The form of coding resembles geometrical figures, in particular lines, grid lines, arcs and/or circles, which are arranged both regularly and irregularly. A partially metallized layer arranged on a substrate comprises several demetallized segments. A discontinuous metallization layer comprises segments of different electrical conductivity.

The device has a capacitively working scanner. This scanner is composed of a large number of transmitting electrodes arranged side by side and a receiving electrode running parallel to this side-by-side arrangement. The scanner is arranged in a document processing machine in such a way that the optical or mechanical sensors provided in usual document processing machines activate the test device according to

the invention. To avoid detecting and measuring errors, a sensor carrier should be used preferably. This sensor carrier accommodates all sensors required for testing. This allows the distances between the sensors to be minimized and the sensors always to be arranged in defined positions. Activation of the individual transmitting electrodes by electric energy is staggered by means of the electronic activation system with a change-over frequency in the kHz range. In addition to the power supply unit, the electronic activation system comprises as major components a multiplexer, an oscillator for the supply of energy to the transmitting electrodes and an oscillator for the activation of the multiplexer.

The energy of the respective activated transmitting electrode is capacitively overcoupled if there is electrical conductivity between the transmitting and the receiving electrode. If there is no electrically conductive feature, no energy will be transferred between the transmitting electrode activated and the receiving electrode. The signal response in the receiving electrode is converted into a relevant signal picture. The signal picture depends on the structure of the metallized layer of the diffraction-optically effective element. If the diffraction-optically effective elements have a discontinuous metallization layer, several segments of the metallization layer have different electrical conductivities. An electronic evaluation system downstream from the receiving electrode compares the signal picture of the test object with the relevant reference signals. The electronic evaluation system is mainly composed of a power supply unit, an amplifier, a demodulator, a comparator, a microprocessor with memory as well as filters for the suppression of external and interference signals.

In addition to the software for the microprocessor, reference signal pictures for comparing with the sampled signal picture of the test document are stored in a memory. As the scanner goes beyond the overall width of the document, the device according to the invention detects every electrically conductive feature. The comparison with the reference signal pictures provides a classifying signal for reprocessing. Therefore, a

document detected as a forgery, for example, could be sorted out by stopping the test device. To reduce interference effects, the sensor carrier is firmly connected to the mounting plate holding the electronic activation and evaluation systems.

The entire test device is arranged within the document processing machine so that the required space is relatively small. The transmitting and receiving electrodes are arranged above or below the documents in the document processing machine in such a way that a reliable scanning is ensured. This is done for example by means of ribbons or in the area of reversing devices so that the document during transport is pressed against the transmitting and receiving electrodes.

In a modified arrangement of the electrodes without affecting the scope of the invention, a long stretched-out transmitting electrode is arranged parallel to the side-by-side arrangement of a large number of receiving electrodes. In this case, the signals received are processed by means of a multiplexer. The rest of the electronic evaluation system is the same as described above.

In another embodiment of the transmitting and receiving electrodes, a large number of transmitting and receiving electrodes are arranged side by side and/or seriatim. For both the activation and the reception of signals, multiplexing or demultiplexing is used.

If the test device is to be used in manual units, the manual units comprise appropriate devices for the transport of the document or the scanner which function like the transport devices in copiers, optical image feeding scanners or fax machines.

As a modification, a device is provided which defines the position of a capacitively working scanner of the test device according to the invention to the document by means of stop elements. In this case, the document is tested only in the area of the transmitting and receiving electrodes.

The features of the invention will appear from the description and drawings in addition to the claims, the individual features as individual or several things in the form of subcombinations representing advantageous, patentable embodiments for which

protection is claimed here. The invention will now be explained in greater detail with reference to embodiments thereof which are represented in the accompanying drawings, wherein

Fig. 1 is a schematic diagram of a document with an OVD with meander-like demetalized layers;

Fig. 2 is a schematic diagram of a document with an OVD with strip-like demetallized layers;

Fig. 3 is a schematic diagram of a document with an OVD with strip-like demetallized layers;

Fig. 4 is a schematic diagram of a document with an OVD with grid-like demetallized layers;

Fig. 5 is a schematic diagram of a document with an OVD with several safety elements;

Fig. 6 is a block diagram of a test device;

Fig. 7 is a schematic diagram of the scanner with a large number of transmitting electrodes and one receiving electrode;

Fig. 8 is a schematic diagram of the scanner with one transmitting and a large number of receiving electrodes;

Fig. 9 is a schematic diagram of the scanner with a large number of transmitting and receiving electrodes;

Fig. 10 is a schematic diagram in a side view of the scanner and a document to be tested;

Fig. 11 is a schematic section through an OVD with demetallized segments;

Fig. 12 is a voltage-time diagram of the evaluation signal;

Fig. 13 is a schematic section through an OVD with a discontinuous metallization layer;

Fig. 14 is a voltage-time diagram of the evaluation signal.

Each of the embodiments shown in Fig. 1 to 5 shows a document with safety elements according to the invention, the capacitively working scanner of the device according to the invention being also represented schematically.

Fig. 2 shows the schematic structure of a printing image 1 with a metallization layer 2. The metallization layer 2 has a demetallized zone 3. Seen from the top, the demetallized zone 3 has the form of a meander. The width of the demetallized zone 3 with the form of a meander is larger than the smallest distance between two electrodes. The capacitively working scanner 4 is composed of a large number of transmitting electrodes 5 arranged side by side and a receiving electrode 6 arranged parallel to this side-by-side arrangement.

Fig. 2 shows the schematic structure of a printing image in which metallized strip-like zones 7 and demetallized strip-like zones 8 are alternately arranged parallel to each other. The zones 7, 8 having the form of strips when seen from the top run parallel or perpendicular to the direction of document transport. The latter case is shown in Fig. 3. The distance between two zones of equal electrical conductivity ranges from 0.2 to 1.0 mm. The width of the zones of equal electrical conductivity varies.

A combination of the features of embodiments 2 and 3 is shown in Fig. 4. Parallel to the direction of document transport, metallized strip-like zones 7 and demetallized strip-like zones 8 are arranged alternately. The metallized zones 7 are interrupted by a strip-like demetallized zone 9 running perpendicular to them.

Fig. 5 shows a document with several printing images. The aimed combination of different printing images results in a further coding. This increases the testing reliability.

Fig. 6 to 9 show the block diagram as well as different embodiments of the capacitively working scanner 4.

Fig. 6 shows the block diagram of the test device according to the invention, which comprises an electronic activation system, a capacitively working scanner 4 and an electronic evaluation system. In addition to the power supply unit, the electronic activation system is mainly composed of a demultiplexer 10, an oscillator 11 for supplying the energy to the transmitting electrodes and an oscillator 12 for the activation of the demultiplexer.

The electronic evaluation system is mainly composed of a power supply unit, an amplifier 13, a demodulator 14, a comparator 15, a microprocessor 16 with memory as well as filters for the suppression of external and interference signals.

The transmitting and receiving electrodes are embedded in a sensor carrier. The electrodes form over the entire feeding width of the document a capacitively working scanner 4. The strip-like receiving electrode runs transversely to the direction of document feeding. The transmitting electrodes are arranged parallel to the receiving electrode. The distance between a transmitting electrode and the receiving electrode is defined by the document-specific electrically conductive testing features. The side-by-side arrangement of several transmitting electrodes allows several electrically conductive features to be simultaneously detected along the longitudinal axis of the capacitively working scanner 4. The resolution achievable with this arrangement depends on the number of transmitting electrodes used. In this embodiment, the resolution is one scannable point per millimetre both in the longitudinal and transverse direction. The minimum distance between adjacent transmitting electrodes is limited by the interfering capacitive coupling among each other. To avoid this and to reduce interfering effects of adjacent transmitting electrodes, the transmitting electrodes are activated one after the other by a multiplexer 10. The arrangement of the transmitting electrodes over the entire feeding width of the document allows the documents to be tested independently of their position. This means that presorting of several documents for a document processing machine is no longer needed.

Fig. 7 shows the schematic diagram of the scanner 4 with a large number of transmitting electrodes 5 and one receiving electrode 6. Activation and evaluation are done according to the block diagram shown in Fig. 6.

Fig. 8 shows a schematic diagram of an embodiment of the capacitively working scanner 4 with one transmitting electrode 17 and a large number of receiving electrodes 18. As a modification of the block diagram of Fig. 6, the transmitting electrode 7 is activated by means of an oscillator. The signals of the receiving electrodes 18 are processed by means of a multiplexer. The rest of the electronic evaluation system comprising the power supply unit, an amplifier, a demodulator, a comparator, a microprocessor with

memory as well as filters for the suppression of external and interference signals resembles that of the block diagram shown in Fig. 6.

Fig. 9 shows the schematic diagram of another embodiment of the capacitively working scanner with a large number of transmitting electrodes 19 and a large number of receiving electrodes 20. These are arranged alternately and serially. Therefore, both the activation signals of the transmitting electrodes 19 and the evaluation signals of the receiving electrodes 20 are processed by the multiplexing or demultiplexing method.

Fig. 10 shows in a side view a schematic diagram of the capacitively working scanner 4 and a document to be tested. The printing image comprises lines 21. The paper of the test object serves as an electrical insulator.

Fig. 11 shows a schematic section through a printing image with a carrying layer 23 and a partial colour print. The partial paint coat 24 contains several colourless segments 25. The relevant evaluation signal is shown in a voltage-time diagram in Fig. 12.

Fig. 13 shows a schematic section through a colour print with a carrying layer 26 and a discontinuous paint coat 27. The discontinuous paint coat 27 contains segments 28, 29, 30, 31, 32 with different electrical conductivity. The relevant evaluation signal is shown in a voltage-time diagram in Fig. 14.

In the present invention, the construction of prints with electrically conductive feature paints and a device for testing such features were explained with reference to embodiments thereof. It is to be understood, however, that the present invention is not limited to the details of the description in the embodiments, as alterations and modifications are claimed within the scope of the patent claims. In addition to the diffraction-optically effective safety element, other electrically conductive features are detected with the device according to the invention. The aimed combination of diffraction-optically effective safety elements with other electrically conductive features results in a further coding. In addition, other electrically conductive testing features such as electrically conductive safety threads can be detected by means of the test device according to the invention.

We claim:

1. Construction of diffraction-optically effective safety elements in documents wherein the diffraction-optically effective safety element is provided with an aimed electrical coding of information comprising a discontinuous metallization layer and/or partially electrically conductive metallic layers and/or zones of metallic layers in different planes.
2. The construction of claim 1 in which the form of coding resembles geometrical figures, in particular lines, grid lines, arcs and/or circles.
3. The construction of claim 1 in which the form of coding resembles regularly or irregularly arranged geometrical figures, in particular lines, grid lines, arcs and/or circles.
4. The construction of claim 1 in which a demetallized zone (3) has the form of a meander when seen from the top.
5. The construction of claim 1 in which metallized strip-like zones (7) and demetallized strip-like zones (8) are alternately arranged parallel to each other, the strip-like zones running parallel or perpendicular to the direction of document transport when seen from the top.
6. The construction of claim 1 in which the distance between two zones of equal and/or different electrical conductivity corresponds to the shortest distance between two electrodes.
7. The construction of claim 6 in which the distance between two zones of equal and/or different electrical conductivity is at least 0.1 mm.

8. The construction as claimed in one or several of the preceding claims in which the metallized zones (7) are interrupted by one or several demetallized zones (9) running perpendicular to the metallized zones.
9. The construction as claimed in one or several of the preceding claims in which the diffraction-optically effective safety element is an optical variable device (1).
10. The construction as claimed in one or several of the preceding claims in which the diffraction-optically effective safety element is a hologram.
11. The construction as claimed in one or several of the preceding claims in which the diffraction-optically effective safety element is a kinegram.
12. A device for the testing of documents with diffraction-optically effective safety elements including a capacitively working scanner (4) whose width exceeds the largest width of the document, comprising a side-by-side arrangement of a large number of electrodes, an electronic activation system and an electronic evaluation system for the comparison of the signal response of the documents to be tested with the relevant reference signal responses.
13. The device of claim 12 in which a large number of electrodes are arranged side by side and/or in several rows.
14. The device of claim 12 in which the electronic activation system comprises a power supply unit, a multiplexer (10), an oscillator (11) for the supply of energy to the transmitting electrodes (5) and an oscillator (12) for the activation of the multiplexer (10).

15. The device of claim 12 in which
the electronic evaluation system comprises a power supply unit, an amplifier (13),
a demodulator (14), a comparator (15), a microprocessor (16) with memory as
well as filters for the suppression of external and interference signals.
16. The device as claimed in one or several of claims 12 to 15 in which
the smallest distance between electrodes is less than 0.5 mm.
17. The device as claimed in one or several of claims 12 to 16 in which
the distance between a transmitting electrode (5) and the receiving electrode (6)
is at least 0.5 mm.
18. The device as claimed in one or several of claims 12 to 17 in which
the device is arranged in high-speed document processing machines.
19. The device as claimed in one or several of claims 12 to 18 in which
the device is arranged in manual units.
20. The device as claimed in one or several of claims 12 to 19 in which
the device is arranged in document reading units.
21. The device as claimed in one or several of claims 12 to 20 in which
the scanner is arranged over the entire width of the document in such a way that
diffraction-optically effective safety elements on one and the same document
which are different in appearance but have the same electrical properties are
compared by means of a microprocessor.
22. The device as claimed in one or several of claims 12 to 21 in which
the scanner is arranged over the entire width of the document in such a way that

diffraction-optically effective safety elements on one and the same document which have the same appearance but are different in electrical properties are compared by means of a microprocessor.

Fig. 6: Output signal

Fig. 11: 24 - printing ink
23 - paper or other carrier

Fig. 13: 26 - carrier (paper)
Printing ink was applied with varying thickness

Summary

This invention relates to the construction of diffraction-optically effective safety elements and a device for testing such elements. Holograms and other diffraction-optically effective safety elements for the protection of certificates and other securities as well as banknotes against forging are now used more and more widely. In accordance with the invention, the diffraction-optically effective element has a discontinuous metallization layer and/or partially metallic layers and/or zones of metallic layers in different planes which provide an aimed electrical coding of information. The device comprises a capacitively working scanner. The scanner comprises a large number of transmitting electrodes arranged side by side and a receiving electrode running parallel to this side-by-side arrangement. The scanner is arranged in a document processing machine in such a way that the optical and mechanical sensors provided in usual document processing machines activate the test device according to the invention. The energy of the respective transmitting electrode activated is capacitively overcoupled if there is electrical conductivity between this transmitting and the receiving electrode. If there is no electrically conductive feature, no energy will be transferred between the transmitting electrode activated and the receiving electrode. The signal response in the receiving electrode is converted into a relevant signal picture. The signal picture depends on the structure of the metallized layer of the diffraction-optically effective element. An electronic evaluation system downstream from the receiving electrode compares the signal picture of the test object with the relevant reference signals.

Legends to illustrations

- 1 OVD
- 2 Metallization layer
- 3 Demetallized zone
- 4 Scanner
- 5 Transmitting electrode
- 6 Receiving electrode
- 7 Metallized zone
- 8 Demetallized zone
- 9 Demetallized zone
- 10 Demultiplexer
- 11 Oscillator for transmitting electrode
- 12 Oscillator for demultiplexer
- 13 Amplifier
- 14 Demodulator
- 15 Comparator
- 16 Microprocessor
- 17 Transmitting electrode
- 18 Receiving electrode
- 19 Transmitting electrode
- 20 Receiving electrodes
- 21 Partial metallization
- 22 Carrying film
- 23 Carrying layer
- 24 Partially metallized layer
- 25 Demetallized segments
- 26 Carrying layer
- 27 Discontinuous metallization layer
- 28 to 23 Segments of the discontinuous metallization layer

The translation comprises fourteen (14) pages.

I, a translator of the English and Japanese languages who was officially appointed and generally sworn by the President of the Regional Court of Dresden, do hereby certify that the above translation of the certificate submitted to me as a copy and drawn up in the German language is correct and complete.

Dresden, 14 April 1998

